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fall very slowly in the air. Theoretically, a small spherical body should fall at the same rate as a large spherical body of the same composition; but it does not, and this may easily be demonstrated by throwing a shovelful of coal composed of pellets of various sizes—some as fine as dust—into the air at a height of even six or eight feet. The very finest dust floats for some time in the air, and the largest pellets reach the ground first. It is indeed due to this surface attraction that small bodies like pollen grains, fungus spores and the like, are capable of being transported through the air over such great distances.

J. B. DANDENO.

AGRICULTURAL COLLEGE, MICHIGAN,
April 3, 1905.

THE WEIGHT OF THE BRONTOSAURUS.

At the request of Professor H. F. Osborn the writer undertook to make an estimate of the probable weight in the flesh of a *Brontosaurus excelsus*. The mounted skeleton in the American Museum is 66 feet 7 inches long, and from this a very carefully studied model or restoration was made by Mr. Charles R. Knight, who also made use of Dr. W. D. Matthew's studies upon the probable size and arrangement of the muscles in this animal. The skeleton was mounted after the prolonged study and discussion of a number of specialists; its contours are strikingly lifelike, and Mr. Knight's long training well qualified him to infer the external contours of an animal from its internal framework. Hence the model should correspond fairly well with the animal itself.

From the model, a number of plaster casts were made, and one of these was used in the following determination. The model was constructed as nearly as possible to the exact scale of one sixteenth natural size, hence the cubic contents of the model multiplied by the cube of 16 (4096) should indicate the probable volume of water which would be displaced by the animal in the flesh. One of the casts was cut into six pieces of convenient size, which were then made water-tight by a double coating of shellac. Professor William Hallock very kindly consented to determine accurately

the cubic contents of these pieces in one of the physical laboratories at Columbia University.

The weight of the cast in air minus its weight in water would equal the weight of an equal volume of water. This differential weight was determined in grams. As a gram is the weight of a cubic centimeter of water the weight of the water displaced gave directly the cubic contents of the model. Professor Hallock found the weight of the water displaced to be 7,595 grams (about .27 cubic feet), or say 7.6 kilograms. Hence the animal itself would displace $7,595 \times (16)^3 = 31,129,600$ c.c. or 31.13 metric tons. Converting this into tons, we have $31.13 \times 2,200 \div 2,000 = 32.24$, or say $34\frac{1}{4}$ tons, as the estimated weight of the water displaced by the animal. But as the animal was probably slightly heavier than the water displaced, in order to enable it to walk on the bottom along the shore of lakes and rivers, we may add about ten per cent. to $34\frac{1}{4}$ tons, securing as a final estimate 38 tons.

This result accords very well with Mr. F. A. Lucas's careful estimate of the weight of a 75-foot sulphur bottom whale, an animal of much greater bulk than the *Brontosaurus*. This weighed about 63 tons, and in conversation with the writer Mr. Lucas expressed the opinion that the *Brontosaurus* did not weigh 'much more than half as much.' This opinion seems justified by the estimate given above.

W. K. GREGORY.

AMERICAN MUSEUM OF NATURAL HISTORY,
NEW YORK,
September 30, 1905.

QUOTATIONS.

COLLEGE ADMINISTRATION.

OF the several conferences of the installation week at Champaign-Urbana, the one announced as a conference of trustees to consider methods of administration builded larger and possibly better than it knew. It included not alone the problems of the conduct of the business machinery of these great corporations, but raised the fundamental issues in regard to *raison d'être* of boards and presidents, and administrative means and measures. And it raised the most pertinent query as to the

dangers inherent in the further development of the presidential office in its present temper. With unexpected corroboration of many men of many minds, the autocracy of the college president—to which President Pritchett has called timely attention—was deplored, not alone as undemocratic in principle and harsh in practise, but as tending to undermine the stability of the academic career, and as taking from it its proper dignity, honor and station. It is certainly notable that an occasion that was convened to glorify the president—though in some part only as the representative of his university—the dominant theme of discussion should take as its text the menace and evils of this office. The inquiry was most amicably and fairly conducted; no disturbing factor of personal criticism intruded itself. It was admitted that the needs of the past—closely associated with pioneering crudities and exacting conditions—demanded dictatorial powers, central responsibility, efficient and compromising direction. Yet it was questioned whether this type of government is at all promising for present and future situations. Our universities have been built up too largely at the sacrifice of the academic career; and with material success and the ambition to be big has come a neglect of quality and of the true ends for which universities are maintained. The faculty has paid all too heavily for the progress which it has, with unacknowledged sacrifice, made possible. The issue is thus nothing less than the rehabilitation of the academic career; the restoration of the faculty to a truly directive authority of the educational affairs of the university; the withdrawal of the president to the more modest office of the leading interpreter of faculty opinion, and the interpretation of the function of the board in a more cooperative, less managerial tone. That intense and hampering sense of accountability—which President Pritchett has likewise emphasized—robs the professorial career of its essential worth; and this accountability directly results from the autocratic government by presidents and boards, that imposes policy upon the faculty, and distributes with both a grudging and an unjust hand rewards for

facilitation of administrative measures. Naturally, when stated thus baldly the charge seems exaggerated and in many quarters wholly inappropriate; yet, as a tendency, it has real existence and unusual power to make or mar the academic career. Analogies from the business world have wrought havoc with educational standards, and, unless signs fail, this is to be one of the foremost of educational questions; and it may be that the formal raising of this query will come to be regarded as the memorable feature of the Illinois conferences.—*The Outlook*.

THE BIRD LIFE OF CENTRAL ILLINOIS.

THE Illinois State Laboratory of Natural History is making a qualitative and quantitative survey of the bird life of a typical grain and cattle farm of central Illinois, with the intention of continuing and extending statistical studies of this description until average results are arrived at, good for the various crops and regions of the state and for the different seasons of the year. This is taken up mainly as a study in ornithological ecology, but it will nevertheless have an economic value as helping to determine the real significance of birds in relation to agriculture.

The data are obtained by an expert field ornithologist who, with a single companion, crosses a four-hundred-acre farm in various directions and at intervals of about four days, the two observers traveling always fifty yards apart and noting the species and numbers of birds flushed on this strip between them. They carry each time a copy of a plot of that part of the farm covered by their trip, drawn to a scale and showing the distribution and areas of each of the crops. On this plot the position of each bird observed is noted, the series of diagrams thus giving a means of determining the average bird population per acre for each crop as well as for the entire area covered.

This work has been in progress since last June, during which time the birds of something over 1,100 acres have thus been accurately recognized and numbered for three summer months. The average was 2.5 birds per acre, omitting English sparrows, or 3.8